

Patient Factors Affecting Emergency Department Utilization and Hospital Readmission Rates after Primary Anterior Cervical Discectomy and Fusion: A review of 41,813 cases

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Background

- The incidence of anterior cervical discectomy and fusion (ACDF) in the United States is increasing. There has been a corresponding interest in factors leading to poor outcomes or readmission after elective spinal surgery as this represents a significant cost burden on the U.S. healthcare system.
- Database studies evaluating hospital readmissions have most frequently reported 30-day rates with less focus on 90-day outcomes.
- Elective surgical procedures have been increasingly targeted for bundled payment models with episodes of care extending to 90-days. As such there is an onus on providers to better define the procedures and patients to which these models are applicable.

Purpose

To identify risk factors leading to emergency department visit at 30 and 90 day timepoints after primary ACDF



Patients were stratified into two groups based on disposition after ED visit

Discharged home from the ED
(ED utilization)

Unplanned hospital readmission

The secondary aim was to determine differences in the risk factor profile between readmitted and discharged patients

Methods

The New York Statewide Planning and Research Cooperative System (SPARCS) database



Queried for

All patients >18y undergoing primary ACDF between 2005 and 2012



Data extracted based on ICD-9 codes

- Demographics
- Comorbidities (Charlson comorbidity index)
- Insurance status
- Discharge disposition
- Length of stay
- Structural indication
- Number of levels fused
- In-hospital complications

Results

Overall Cohort Demographics

- 41,813 patients identified
- Majority white, healthy, degenerative indication, 1-2 levels
- Low rates of in-hospital complications

Characteristics	N=41,813
Average Age (yrs)	50.7 (11.8)
Age group (yrs)	
18-34	2885 (6.9)
35-49	17866 (42.7)
50-59	12118 (29.0)
≥60	8944 (21.4)

Gender (%)	
Male	20597 (49.3)
Female	21216 (50.7)

Race and ethnicity (%)	
White	29486 (70.5)
Black	4928 (11.8)
Other/Unknown	7399 (17.7)

CCI (%)	
0	29653 (70.9)
1	9431 (22.6)
≥2	2729 (6.5)

Insurance status (%)	
Medicare	7007 (16.8)
Medicaid	4115 (9.8)
Private	18563 (44.4)
Workers' compensation	6343 (15.2)
Other	5785 (13.8)

Discharge disposition (%)	
Home	39139 (93.6)
Short-term hospital/SNF	1056 (2.5)
Rehab	1363 (3.3)
Hospice/Other facility	255 (0.6)

Structural Indication (%)	
Infectious	181 (0.4)
Traumatic	1691 (4.0)
Pathologic	358 (0.9)
Degenerative	40427 (96.7)

In-hospital complications (%)	
Other major systemic	138 (0.3)
GI	63 (0.1)
Respiratory	417 (1.0)
Peripheral vascular	77 (0.2)
Other surgical	92 (0.2)
Dysphagia	616 (1.5)
Dural tear	136 (0.3)
Major bleed	154 (0.4)
Infectious	124 (0.3)

Length of stay, days*	1 (1, 2)
≤1 day	22804 (54.5)
>1 day	19009 (45.5)

Fusion 2-3 vertebrae (%)	35068 (83.9)
Fusion 4-8 vertebrae (%)	4967 (11.9)

Complications grouped as systemic or surgical for purposes of analysis

Risk factors for 30-day ED utilization

2,514 Patients (6.0%)

	Odds Ratio	95% CI	P-value
Age group			
18-34	Ref		
35-49	0.744	0.639, 0.865	<0.001
50-59	0.573	0.487, 0.675	<0.001
≥60	0.523	0.435, 0.630	<0.001
Gender			
Male	Ref		
Female	1.045	0.961, 1.137	0.302
Race and ethnicity			
White	Ref		
Black	1.189	1.055, 1.340	0.004
Other/Unknown	0.737	0.654, 0.831	<0.001
Insurance status			
Private	Ref		
Medicare	1.819	1.585, 2.087	<0.001
Medicaid	2.706	2.386, 3.068	<0.001
Workers' compensation	1.300	1.140, 1.482	<0.001
Other	1.484	1.303, 1.691	<0.001
CCI			
0	Ref		
1	1.287	1.168, 1.418	<0.001
≥2	1.321	1.120, 1.559	0.001

	Odds Ratio	95% CI	P-value
Discharge disposition			
Home	Ref		
Short-term hospital/SNF, Hospice/Other facility	0.964	0.766, 1.213	0.753
Rehab	0.502	0.378, 0.667	<0.001
Structural Indication			
Degenerative	Ref		
Infectious/ Pathologic	0.838	0.468, 1.501	0.553
Traumatic	1.035	0.806, 1.327	0.790
Length of stay			
≤1 day	Ref		
>1 day	1.230	1.126, 1.343	<0.001
# of levels fused			
Fusion 2-3 vertebrae	Ref		
Fusion 4-8 vertebrae	1.169	1.035, 1.319	0.012
In-hospital complications			
No comps	Ref		
Systemic	1.178	0.818, 1.698	0.379
Surgical	1.108	0.865, 1.420	0.416

Risk factors for 30-day ED visit:

- Age <35
- Non-private insurance
- >1 comorbid condition
- LOS >1 day
- Fusion of >2 levels

Patients discharged to a rehab facility were less likely to return to the ED

Risk factors for 90-day ED utilization

4,609 Patients (11.0%)

	Odds Ratio	95% CI	P-value
Age group			
18-34	Ref		
35-49	0.723	0.644, 0.812	<0.001
50-59	0.543	0.479, 0.616	<0.001
≥60	0.437	0.379, 0.505	<0.001
Gender			
Male	Ref		
Female	1.157	1.085, 1.234	<0.001
Race and ethnicity			
White	Ref		
Black	1.241	1.132, 1.360	<0.001
Other/Unknown	0.819	0.750, 0.895	<0.001
Insurance status			
Private	Ref		
Medicare	1.924	1.732, 2.138	<0.001
Medicaid	2.850	2.587, 3.141	<0.001
Workers' compensation	1.322	1.196, 1.461	<0.001
Other	1.492	1.351, 1.648	<0.001
CCI			
0	Ref		
1	1.288	1.195, 1.388	<0.001
≥2	1.496	1.322, 1.692	<0.001

90-day risk factors largely mirrored those of the 30-day cohort

	Odds Ratio	95% CI	P-value
Discharge disposition			
Home	Ref		
Short-term hospital/SNF, Hospice/Other facility	1.125	0.947, 1.336	0.179
Rehab	0.826	0.688, 0.991	0.040
Structural Indication			
Degenerative	Ref		
Infectious/ Pathologic	0.960	0.634, 1.453	0.845
Traumatic	0.984	0.812, 1.191	0.865
Length of stay			
≤1 day	Ref		
>1 day	1.246	1.165, 1.334	<0.001
# of levels fused			
Fusion 2-3 vertebrae	Ref		
Fusion 4-8 vertebrae	1.148	1.045, 1.261	0.004
In-hospital complications			
No comps	Ref		
Systemic	1.019	0.765, 1.358	0.896
Surgical	1.139	0.945, 1.373	0.171

Patients with private insurance or those discharged to a rehab facility were again less likely to present to the ED

Risk Factors for 30-day Hospital Readmission

1,394 Patients (3.3%)

	Odds Ratio	95% CI	P-value
Age group			
18-34	Ref		
35-49	1.515	1.118, 2.053	0.007
50-59	1.557	1.141, 2.123	0.005
≥60	1.774	1.287, 2.446	<0.001
Gender			
Male	Ref		
Female	0.707	0.630, 0.792	<0.001
Race and ethnicity			
White	Ref		
Black	1.099	0.936, 1.290	0.251
Other/Unknown	0.901	0.772, 1.051	0.184
Insurance status			
Private	Ref		
Medicare	1.708	1.443, 2.021	<0.001
Medicaid	1.786	1.484, 2.149	<0.001
Workers' compensation	1.092	0.899, 1.327	0.375
Other	1.102	0.906, 1.342	0.331
CCI			
0	Ref		
1	1.324	1.159, 1.512	<0.001
≥2	1.780	1.489, 2.129	<0.001

	Odds Ratio	95% CI	P-value
Discharge disposition			
Home	Ref		
Short-term hospital/SNF, Hospice/ Other facility	2.901	2.396, 3.513	<0.001
Rehab	1.257	0.989, 1.597	0.061
Structural Indication			
Degenerative	Ref		
Infectious/ Pathologic	3.296	2.255, 4.818	<0.001
Traumatic	1.409	1.072, 1.853	0.014
Length of stay			
≤1 day	Ref		
>1 day	1.661	1.459, 1.890	<0.001
# of levels fused			
Fusion 2-3 vertebrae	Ref		
Fusion 4-8 vertebrae	1.123	0.965, 1.308	0.134
In-hospital complications			
No comps	Ref		
Systemic	1.982	1.469, 2.674	<0.001
Surgical	1.635	1.285, 2.081	<0.001

Compared to 30-day ED visits, age >35 years, discharge to a short-term care facility, indication other than degenerative, and any in-hospital complication were risk factors for readmission at 30 days

Patient race and number of levels fused did not factor into the likelihood of readmission by 30 days after discharge

Risk factors for 90-day Hospital Readmission

2,223 Patients (5.3%)

	Odds Ratio	95% CI	P-value
Age group			
18-34	Ref		
35-49	1.313	1.045, 1.650	0.019
50-59	1.400	1.108, 1.768	0.005
≥60	1.550	1.215, 1.979	<0.001
Gender			
Male	Ref		
Female	0.777	0.709, 0.851	<0.001
Race and ethnicity			
White	Ref		
Black	1.044	0.915, 1.190	0.526
Other/Unknown	0.877	0.774, 0.993	0.038
Insurance status			
Private	Ref		
Medicare	1.816	1.587, 2.079	<0.001
Medicaid	2.029	1.754, 2.348	<0.001
Workers' compensation	1.097	0.939, 1.281	0.244
Other	1.138	0.973, 1.329	0.105
CCI			
0	Ref		
1	1.423	1.281, 1.582	<0.001
≥2	2.092	1.812, 2.415	<0.001

	Odds Ratio	95% CI	P-value
Discharge Disposition			
Home	Ref		
Short-term hospital/SNF, Hospice/ Other facility	2.465	2.092, 2.905	<0.001
Rehab	0.789	0.632, 0.985	0.036
Structural Indication			
Degenerative	Ref		
Infectious/ Pathologic	2.947	2.087, 4.161	<0.001
Traumatic	1.634	1.309, 2.040	<0.001
Length of stay			
≤1 day	Ref		
>1 day	1.634	1.477, 1.809	<0.001
# of levels fused			
Fusion 2-3 vertebrae	Ref		
Fusion 4-8 vertebrae	1.089	0.961, 1.234	0.180
In-hospital complications			
No comps	Ref		
Systemic	2.191	1.692, 2.838	<0.001
Surgical	1.536	1.248, 1.890	<0.001

Similar to risk factors for 30 vs 90 day ED utilization, 90-day readmission risk factors mirrored those at 30 days

Discussion and Conclusions

- Patients return to the ED for evaluation and are subsequently discharged at nearly twice the rate that they are readmitted at both 30 and 90 days after discharge following primary ACDF.
- **Overall Risk Factors:** Patients having **Medicare or Medicaid insurance**, presence of **comorbidities**, and a **length of stay greater than one day** were more likely to visit the ED or have an unplanned hospital readmission at both 30 and 90 days.
- Patients self-identifying as black race/ethnicity and those undergoing fusion of >2 levels were more likely to utilize the ED at both 30 and 90 days → did not predict readmissions
- Patients <35 years visiting the ED → more likely to be discharged home
Age >35 years → risk factor for readmission at both timepoints.
- Individuals who were discharged to a rehab facility were less likely to present to the ED by 90 days compared to those discharged home, while those discharged to another healthcare facility (short-term hospital, skilled nursing facility or hospice) were more likely to have an unplanned readmission at both 30 and 90 days

Discussion and Conclusions

With better understanding of baseline demographic risk factors for hospital utilization, spine surgeons may provide either **preoperative counseling to at-risk patients** in order to prevent unnecessary ED visits or **appropriate intervention for patients with known risk factors** for readmission.

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